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F2D DDA

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JP 110041858 A **JP 070011825 A**
US 5810144 A **US 4093289 A**

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Other: **Online: WPI, EPODOC, JAPIO, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1 & TXTWO1**

(54) Abstract Title: **Rotery drive**

(57) A rotary drive has a gear sector 120 in mesh with a drive pinion (110, fig 5). A member (140, fig 2) is mounted for rotation coaxially of the gear sector 120, spring means 148 being mounted on one of the gear sector 120 or member and abutment means 134,146 on the other of the gear sector 120 or member engaging the spring means 148 to bias the member to a central position relative to the gear sector 120. The spring means applies a restoring force towards the central position upon relative movement of the member 140 with respect to the gear selector 120 and stop means 154 is provided to limit relative movement in either direction. The member is drivingly connected to an output shaft 80. The spring means 148 may be U-shaped.

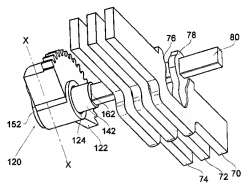

Fig 2.

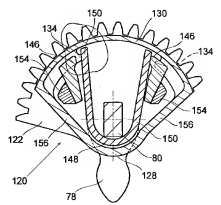

Fig 6.

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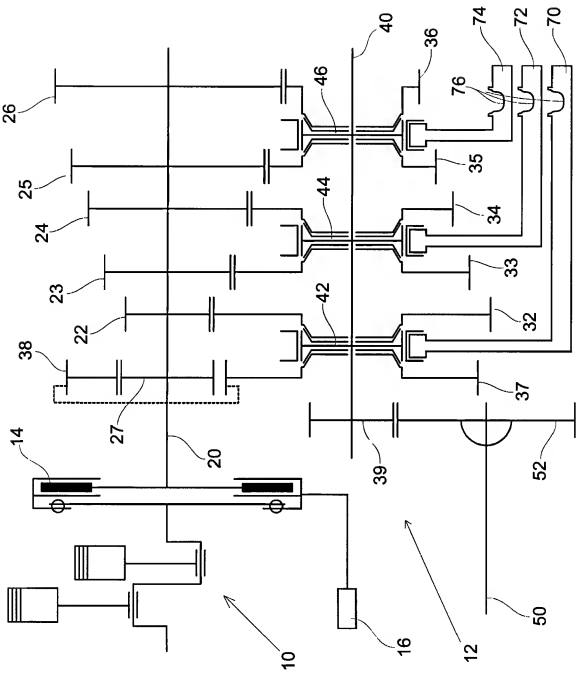
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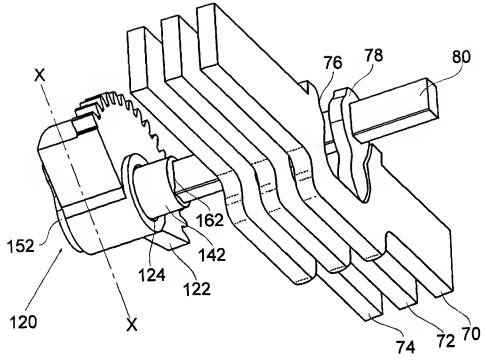
Fig 1.


X
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78
80
162
152
142
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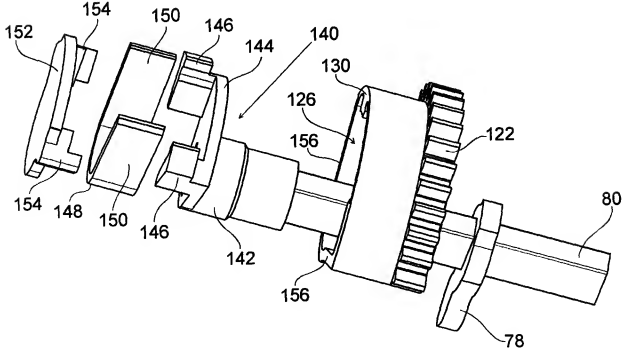
120
X
74
72
70

Fig 2.


154
150
146
152
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122
80
154
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156
78

Fig 3

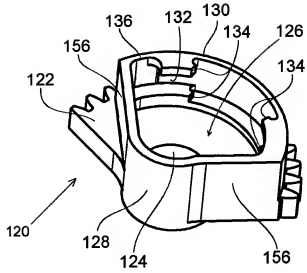

Fig 4.

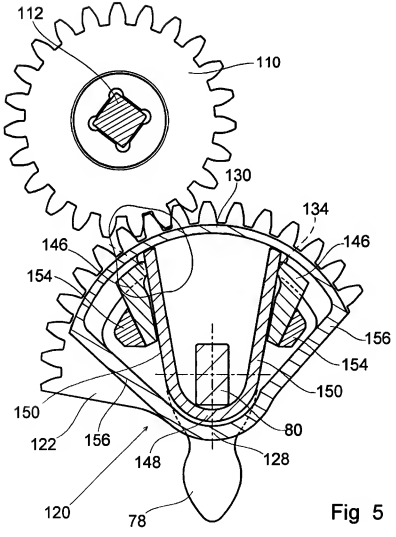

Fig 5

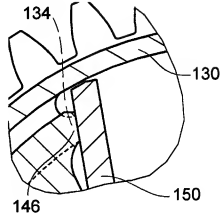

Fig 5a

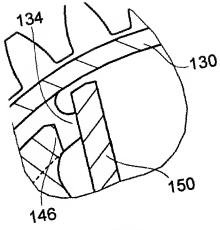

Fig 6a

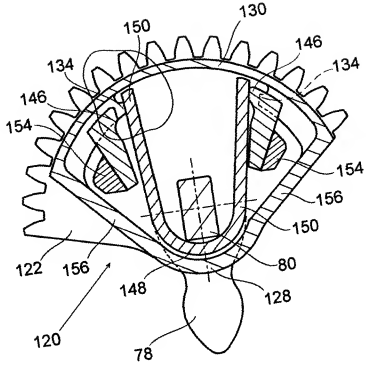

Fig 6.

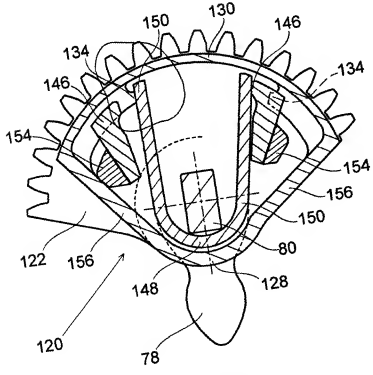

Fig 7.

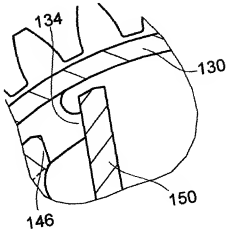

Fig 7a

ROTARY DRIVE MEANS

The present invention relates to rotary drive means and in particular rotary drive means, for example as used in gear shift mechanisms, when limited angular movement is required, the drive means incorporating a drive pinion which meshes with a gear sector.

In such rotary drives, there is often a requirement to provide elasticity in the drive in order to limit the loads applied to the components driven by the rotary drive means or to provide means for pre-loading such components.

Hitherto this has been achieved by providing elasticity elements in the drive between the pinion and means, for example electric motor, by which the pinion is driven. Such elasticity elements typically comprise a pair of discs with resilient means acting therebetween, for example as disclosed in US 6003395, US6220109 and 6003649, the disclosure contents of which are incorporated into the disclosure content of the present application by reference thereto.

The present invention provides a rotary drive in which the elasticity element is incorporated into the gear sector. The elasticity element of the present invention also allows for pre-stressing of the elasticity element and control of deflection.

According to one aspect of the present invention a rotary drive comprises a drive pinion and a gear sector meshingly engaging the drive pinion, a member mounted for rotation coaxially of the drive sector, spring means being mounted on one of the gear sector or member, abutment means on the other of the gear sector or member engaging the spring means to bias the member to a central position relative to the gear sector, the spring means applying a restoring force towards the central position upon relative movement of the member with respect to the gear sector and stop means being provided to limit relative movement of the member

with respect to the gear sector in either direction, away from the central position, the member being drivingly connected to an output shaft.

In accordance with the present invention, relative movement of the member with respect to the gear sector under the influence of the spring, will provide elasticity to limit the load applied to the driven components and/or to pre-load the components.

According to a preferred embodiment of the present invention, the member and spring means are mounted within a cavity formed in the gear sector, thereby producing a compact arrangement which may be conveniently packaged in, for example, a gear selector mechanism of a motor vehicle.

An embodiment of the invention is now described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 illustrates diagrammatically a gearbox of a motor vehicle;

Figure 2 illustrates a gearshift mechanism for the gearbox illustrated in Figure 1, utilising a rotary drive mechanism in accordance with the present invention;

Figure 3 is an exploded view of the mechanism illustrated in Figure 2;

Figure 4 is a view of the gear sector of the mechanism illustrated in figure 2;

Figure 5 is a sectional end elevation through the mechanism, along the line X – X of Figure 2, showing the mechanism in a first position;

Figure 5a is an enlarged view of the circled portion of Figure 5;

Figure 6 is a sectional end elevation through the mechanism, along the line X – X of Figure 2, showing the mechanism in a second position;

Figure 6a is an enlarged view of the circled portion of Figure 6;

Figure 7 is a sectional end elevation through the mechanism, along the line X – X of Figure 2, showing the mechanism in a third position; and

Figure 7a is an enlarged view of the circled portion of Figure 7.

In the transmission system illustrated in Figure 1 a clutch 14, when engaged, transmits torque between the output shaft of engine 10 and an input shaft 20 of a gearbox 12. Engagement of clutch 14 is controlled by clutch slave cylinder 16 in conventional manner.

Input shaft 20 has six gears 22,23,24,25,26 and 27 mounted thereon for rotation therewith. Gears 22,23,24,25 and 26 mesh with gears 32,33,34,35 and 36 respectively and gear 27 meshes with gear 37, via an intermediate gear 38. The gears 32,33,34,35,36 and 37 are mounted on a lay shaft 40, which is mounted parallel to but spaced from input shaft 20. Gears 32,33,34,35,36 and 37 are mounted on lay shaft 40 for rotation relative thereto. Gears 32 and 37 are selectively engaged for rotation with lay shaft 40 by means of a synchromesh unit 42; gears 33 and 34 are selectively engaged for rotation with lay shaft 40 by means of a synchromesh unit 44; and gears 35 and 36 are selectively engaged for rotation with lay shaft 40 by means of a synchromesh unit 46.

The gears 22 and 32 are sized to provide a first gear ratio; gears 23 and 33 a second gear ratio; gears 24 and 34 a third gear ratio; gears 25 and 35 a fourth gear ratio; and gears 26 and 36 a fifth gear ratio; while intermediate gear 38 reverses the direction of rotation so that gears 27 and 37 provide a reverse gear ratio.

The lay shaft 40 is drivingly connected to an output shaft 50 from the gearbox12, via gears 39 and 52.

The synchromesh units 42,44 and 46 are controlled by shift rails 70,72 and 74 respectively, axial movement of the shift rails 70,72 and 74 moving the synchromesh units 42,44 and 46 respectively, axially of the lay shaft 40. In this manner synchromesh unit 42 (as illustrated in figure 1) may be moved to the left, to engage gear 37 with layshaft 40, thereby engaging reverse gear; or to the right to engage gear 32 with lay shaft 40 thereby engaging first gear. Synchromesh unit 44 may be moved to the left to engage gear 33 with layshaft 40, to engage second gear; or the right to engage gear 34 with lay shaft 40, to engage third gear. Synchromesh unit 46 may be moved to the left to engage gear 35 with lay shaft 40, to engage fourth gear; or the right to engage gear 36 with lay shaft 40, to engage fifth gear.

As illustrated in figure 2, each of the shift rails 70,72 and 74 has a notch 76, the notches 76 in the shift rails 70,72 and 74 being aligned transversely of the shift rails 70,72 and 74, when the synchromesh units 42,44 and 46 are in a central, neutral position, in which neither gear 32,37; 33,34; or 35,36 associated with each respective synchromesh unit 42,44 and 46 is engaged with the lay shaft 40. The notches 76 are engaged by a shift finger 78 which is slidingly mounted on a shaft 80, the axis of the shaft 80 being transverse to the longitudinal axis of the shift

rails 70,72 and 74. The shaft 80 is of rectangular section so that rotation thereof will rotate the shift finger 78 in a plane parallel to the longitudinal axes of the shift rails 70,72 and 74, rotation of the shift finger 78 causing the shift rail with which it is engaged to move axially in one direction or the other, depending on the direction of rotation.

Means, for example as disclosed in co-pending application WO 02/066870, the disclosure content of which is incorporated into the disclosure content of the present application by reference thereto, is provided for movement of shift finger 78 axially of shaft 80, so that it may be aligned axially with one of the shift rails 70,72 and 74.

As illustrated in Figures 2 to 7, shaft 80 is rotated in one direction or the other by means of a drive mechanism comprising a drive pinion 110, which is drivingly connected to drive means, for example an electric motor, by means of drive shaft 112.

The drive pinion 110 meshes with a gear sector 120 to provide limited angular rotation of an output shaft 80, in each direction.

The gear sector 120 comprises a toothed section 122, which is concentric with an axial bore 124. The gear sector 120 also defines an axially extending cavity 126 of sectorial section. The apex 128 of the cavity 126 is part circular, being coaxial with the bore 124.

The outer curved wall 130 of the cavity 126 has a circumferential groove 132 on its internal diameter, the central section of the walls defining the groove 132 being removed to define two pairs of abutments 134, the abutments 134 of each pair of abutments being located adjacent the axially inner and outer extremities of the cavity 126.

A spring retainer 140 has a spigot formation 142, which rotatably engages the bore 124 of the gear sector 120. A sectorial flange formation 144 is provided at the end of the spigot 142, the sectorial flange 144 being dimensioned to locate within the cavity 126. The angular extent of the sectorial flange 144 is less than that of the cavity 126, so as to permit relative rotation of the spring carrier 140 with respect to the gear sector 120.

A pair of abutments 146 are provided on the spring carrier 140, a U-shaped spring 148 being located between the abutments 146, the spring 148 being compressed to a predetermined pre-load.

The abutments 146 extend into the groove 132 in cavity 126 and correspond angularly to the abutments 134 formed by the walls of the groove 132. In this manner, when in a central position as shown in Figure 5, the limbs 150 of the spring 148 will engage abutments 146 on the spring carrier 140 and abutments 132 on the gear sector 120.

In order to permit assembly of the spring carrier 140 into the cavity 126, the upper wall defining groove 132 is cut away at one end 136, so that when the spring carrier 140 is rotated to that end 132, one abutment 146 will be aligned with the cut-out portion at end 136 while the other abutment 146 is aligned with the central cut-out portion, thereby permitting the spring carrier 140 to be inserted axially into the cavity 126 and then rotated so that abutments 146 engage in the groove 132.

An end plate 152 is adapted to be secured to the spring carrier 140 in order to retain the spring 148 in position. The end plate 152 has a pair of abutments 154 which engage on the outer surfaces of abutments 146 on the spring carrier 140, so that the abutments 154 will engage the radial walls 156 of the cavity 126, to limit angular rotation of the spring carrier 140 with respect to the gear sector 120.

The shaft 80 drivingly engages a correspondingly shaped socket 162 in the spigot portion 142 of spring carrier 140, for rotation therewith.

In order to move the shift rails 70,72 and 74 axially, to engage one of the gears 32,37; 33,34; or 35,36 associated therewith, the shift finger 78 is aligned with the appropriate shift rod 70,72 or 74. The shift finger 78 is then rotated in one direction or the other by means of the drive pinion 110 and gear sector 120 to move shift rail 70,72,74 in the appropriate direction to engage the required gear associated therewith.

The U-shaped spring 148 is pre-loaded between the abutments 146 on the spring carrier 140, so that at low input torque, the drive will be transmitted from the gear sector 120, abutments 134 and the limbs of spring 148 to the abutments 146 on the spring carrier 140 and thereby to the output shaft 80, without deflection of the spring 148.

However, when the torque applied to the gear sector 120 increases above the pre-load on "U" spring 148, the gear sector 120 will compress the "U" spring 148, causing relative movement between the gear sector 120 and spring carrier 140, as illustrated in Figure 6. Relative movement between the gear sector 120 and spring carrier 140 is limited by engagement of the abutment 154 against the wall of the cavity 126 as illustrated in Figure 7. Compression of the spring 148 will thereby cushion the engagement of the synchromesh units 42,44 and 46, avoiding damage thereto by the application of excessive loads.

Various modifications may be made without departing from the invention, for example while the invention has been described with reference to a gear selector mechanism, the drive may also be used in other applications where limited angular reciprocating drive is required, such as clutch actuation means.

While in the embodiment described with respect to the accompanying drawings, the spring 148 is mounted with respect to the output shaft 80 and is deflected by movement of the gear sector 120, it will be appreciated that the spring 148 may alternatively be mounted on the gear sector 120, so that it will be deflected by the reaction to movement of the output shaft 80.

Furthermore, while in the above embodiment fixed stops are provided by abutments 154, alternatively adjustable stops, for example set screws located in threaded holes through walls 156, for engagement of the abutments 146, may be provided.

The output shaft 80 may be of any non-circular section which will permit axial movement of the shift finger 78 but will transmit rotary motion thereto. For example in addition to being of rectangular section as described above, the output shaft 80 may be of hexagonal section, splined or of circular section with a flat extending axially thereof.

While in the above embodiment of the invention the elasticity in the drive mechanism is used to cushion loads applied to the components driven thereby, the elasticity may alternatively or in addition be used to preload the components into engagement.

The patent claims submitted with the application are proposed formulations without prejudice to the achievement of further patent protection. The applicant reserves the right to submit claims for further combinations of characteristics, previously only disclosed in the description and/or drawings.

References back used in sub-claims refer to the further development of the subject of the main claim by the characteristics of the respective sub-claim; they

are not to be understood as a waiver with regard to achieving independent item protection for the combination of characteristics in the related sub-claims.

Since the subject of the sub-claims can form separate and independent inventions with reference to the prior art on the priority date, the applicant reserves the right to make them the subject of independent claims or of division declarations. Furthermore, they may also contain independent inventions, which demonstrate a design, which is independent of one of the objects of the preceding sub-claims.

The embodiments are not to be considered a restriction of the invention. Rather, a wide range of amendments and modifications is possible within the scope of the current disclosure, especially those variations, elements and combinations and/or materials which, for example, the expert can learn by combining individual ones together with those in the general description and embodiments in addition to characteristics and/or elements or process stages described in the claims and contained in the drawings with the aim of solving a task thus leading to a new object or new process stages or sequences of process stages via combinable characteristics, even where they concern manufacturing, testing and work processes.

Claims

1. A rotary drive comprising a drive pinion (110) and a gear sector (120) meshingly engaging the drive pinion (110), a member (140) mounted for rotation coaxially of the drive sector (120), spring means (148) being mounted on one of the gear sector (120) or member (140), abutment means (134,146) on the other of the gear sector (120) or member (140) engaging the spring means (148) to bias the member (140) to a central position relative to the gear sector (120), the spring means (148) applying a restoring force towards the central position upon relative movement of the member (140) with respect to the gear sector (120) and stop means (154) being provided to limit relative movement of the member (140) with respect to the gear sector (120) in either direction, away from the central position, the member (140) being drivingly connected to an output shaft (80).

2. A rotary drive according to claim 1 in which the member (140) comprises a spring carrier, the spring being mounted with respect to the spring carrier and abutment means (134) being provided on the gear sector (120) for engagement if the spring means (148).

3. A rotary drive according to claim 2, in which the spring means (148) is "U" shaped, the spring means (148) having a pair of limbs (150), the limbs (150) engaging abutments (146) on the spring carrier (140).

4. A rotary drive according to claim 3 in which the spring means (146) is pre-loaded to a predetermined value, when the limbs (150) engage the abutments on the spring carrier (140).

5. A rotary drive according to claim 3 or 4 in which the spring carrier (140) has a flange formation (144) of sectorial section, the flange formation being disposed

within a sectorial cavity (126) provided in the gear sector, the angular extent of the cavity being greater than that of the flange formation (144) to allow limited rotation of the flange formation in the cavity (126).

6. A rotary drive according to claim 5 in which an outer curved wall (130) of the cavity (126) has a circumferential groove formation (132) on its internal diameter, a central portion of the walls defining the groove formation (132) being removed to define two pairs of abutments (134), the abutments (134) engaging the ends of the limbs (150) of spring means (148), one abutment (134) of each pair on either side of the abutments (146) on the spring carrier (140).

7. A rotary drive according to claim 6 in which the abutments (146) on the spring carrier (140) engage in the circumferential groove formation (132).

8. A rotary drive according to claim 7 in which an end portion of the outer wall defining the groove formation (132) is removed to permit axial insertion of the spring carrier (140) into the cavity (126), so that the abutments (146) engage the groove formation (132).

9. A rotary drive according to any one of claims 5 to 8 in which an end plate (152) is secured to the spring carrier (140) to retain the spring means (148).

10. A rotary drive according to claim 9 in which a pair of abutments (154) on the end plate (152) are adapted to engage the radial walls of the cavity (126) to limit relative rotation of the spring carrier (140) relative to the gear sector (120).

11. A rotary drive according to claim 10 in which the abutments (154) on the end plate (152) engage outer sides of the abutments (146) on the spring carrier (140).

12. A rotary drive substantially as described with reference and as shown in figures 2 to 7a, of the accompanying drawings.

13. A shift mechanism for a multi-ratio gearbox comprising a plurality of shift rails (70,72,74), a shift finger (78) adapted to engage a notch (76) in each of the shift rails (70,72,74), means being provided to move the shift finger (78) transversely of the shift rails to bring the shift finger (78) into alignment with a notch (76) in one of the shift rails (70,72,74) and a rotary drive as claimed in any one of claims 1 to 12 to rotate the shift finger (78) in one direction or the other and thereby move the shift rail (70,72,74) axially in one direction or the other, to engage a gear associated with the shift rail (70,72,74).

14. A shift mechanism according to claim 13 in which the output shaft (80) of the rotary drive is located transversely of the shift rails (70,72,74), the shift finger (78) being mounted on the output shaft (80) so that it slides thereon but is fixed rotationally with respect thereto.

15. A shift mechanism according to claim14 in which the output shaft (80) is of non-circular section.

16. A shift mechanism substantially as described herein with reference to and as shown in figures 1 to 7a of the accompanying drawings.

Application No:	GB 0223531.5	13	**Examiner:**	Jason Clee
Claims searched:	1 to 16		**Date of search:**	26 March 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1 & 2	US 5810144	(Fichtel & Sachs AG) especially see the abstract and figures
X	1 & 2	US 4093289	(Toyo Kogyo Co. Ltd & Tanaka Instrument Co. Ltd) especially see the abstract and figures
X	1 & 2	JP 07011825 A	(Nipon Denso Co. Ltd) especially see the abstract and figures
X	1 & 2	JP 11041858 A	(Ohi Seisakusho Co. Ltd) especially see the abstract and figures

Categories.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V].

F2D & F2Q

Worldwide search of patent documents classified in the following areas of the IPC[7]:

F16H

The following online and other databases have been used in the preparation of this search report:

Online WPI, EPODOC, JAPIO, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1 & TXTWO1